

THE MARS MICROMISSION SPACECRAFT

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The concept of a small common Mars Micromission spacecraft design, using the Ariane-5 GTO piggyback launch opportunities has been studied over the past year by NASA/JPL and CNES. The study is based on the 200 kg ASAP twin configuration, due to its clear performance and cost advantages for planetary missions over the 100-kg ASAP configuration. The spacecraft design commonality has been explored for the Mars 2003, 2005, and 2007 launch opportunities and for three main mission types:

- ☐ **Probe Carrier** missions, with one or more probes, measuring 40-80 cm in diameter
- ☐ **Science Orbiter** missions, with additional fuel for orbit insertion
- ☐ **Telecommunication Relay Orbiter** missions, with optimal data return link

The Ariane-5 offers a unique low cost capability to launch planetary missions as piggyback payloads together with commercial satellite launches to Geosynchronous Transfer Orbits (GTO). The piggyback payloads are mounted below the primary payloads on the ring-shaped Ariane-5 Structure for Auxiliary Payloads (ASAP). From GTO, the spacecraft will use on-board liquid propulsion to inject into Earth escape trajectories to Mars, Venus or other nearby planetary objects. By using a low delta-V multi-burn strategy involving Lunar and Earth flyby, the launch period is extended to 3-4 Months to provide sufficient flexibility for the Ariane-5 launch scheduling of its primary payloads. To date, Ariane-4 has launched 22 piggyback payloads on its ASAP to various low earth orbits, at a rate of about one launch per year and 2-6 satellites per launch. With the increased lift capability and fairing size on Ariane-5, it is able to carry up to eight 100-kg (standard) payloads or four 200-kg (twin) payloads on its ASAP platform.

The level of commonality between the three planetary mission types has been optimized to ensure a low recurrent cost of the spacecraft bus. The study results to date will be presented for the baseline common Mars Micromission spacecraft, including:

- ☐ ASAP and spacecraft configuration/layout
- ☐ Comparison of key mission requirements and performance capabilities
- ☐ Major design trades
- ☐ Payload accommodation (see target capabilities below)
- ☐ Technology heritage/needs/risk
- ☐ Cost and schedule

Target Payload Capabilities	Mars/2003	Mars/2005	Mars/2007
Probe Carrier			
- Delta-V requirement (m/s)	1600	1800	1600
- Payload Capability (kg)	25-30	30-40	40-50
(a) Small probes (~40-cm diameter)	2-4	4	4-6
(b) Medium probes (~60-cm diameter)	2	2	3
(c) Large probe (~80-cm diameter)	1	1	1
Science/Telecom Relay Orbiter			
- Delta-V requirement (m/s)	2700	3200	2900
- Payload Capability (kg)	5	5-10	10-15